MAPÚA UNIVERSITY
Department of Physics

E301: LINEAR EXPANSION

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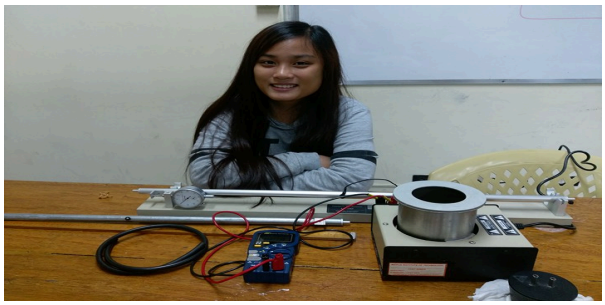
PHY11L-A3 Group 3



PROGRAM OUTCOME A. Ability to apply knowledge of mathematics, science and engineering	
Data Sheet / Computation (10)	
PROGRAM OUTCOME G. Ability to communicate effectively	
Presentation / Graph, Figures and Tables (10)	
PROGRAM OUTCOME B. Ability to design and conduct experiments, as well as to analyze and interpret data	
Results and Discussion (15)	
Conclusion / Error Analysis (15)	
PROGRAM OUTCOME K. Ability to use the techniques, skills, and modern engineering tools necessary for engineering practice	
Application (10)	
Performance	
TOTAL	55

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E301: LINEAR EXOANSION

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Introduction

Whenever temperature changes, all materials and matter undergo a change in its size and dimension. As the temperature rises, the volume, area, or the size of a certain material changes in such a way that it expands, in contrast, when the temperature drops, the volume, area, or the size of a certain material changes in such a way that it gets smaller.

This experiment aims to determine the coefficient of linear expansion of a metal rod, and to determine the factors affecting the change in length in thermal expansion.

Results and Discussion

Table 1: Determination of Coefficient of Linear Expansion

TYPE OF TUBE	ALUMINUM	STEEL TUBE
	Trial 1	Trial 1
INITIAL LENGTH OF TUBE, L	704.00	702.00
INITIAL RESISTANCE OF THERMISTOR AT ROOM TEMP.	112.5	109.6
INITIAL TEMPERATURE	22.00	23
CHANGE IN LENGTH OF TUBE	1.27	0.60
RESISTANCE OF THERMISTOR AT FINAL TEMP.	11.86	13.36
FINAL TEMPERATURE OF THE TUBE	77.00	74.00
CHANGE IN TEMPERATURE OF THE TUBE	55.00	51.00
EXPERIMENTAL COEFFICIENT OF LINEAR EXPANSION	0.0000328	0.0000168
ACTUAL COEFFICIENT OF LINEAR EXPANSION	0.0000238	0.0000120
PERCENT ERROR	37.82 %	39.66 %

By using the obtained data shown above, the coefficients of the linear expansion of the two different types of tubes were calculated. And the formula to obtain their coefficients of linear expansion is shown below:

$$\Delta L = L_o \alpha \Delta T \quad (1)$$

From the data obtained in the experiment above, the final temperature recorded from the aluminum tube is around 77°C, Since the water is already boiling, this should be about 100°C which should be the boiling point of water, but due to some experimental errors the students of the group were able to achieve a much lower value than the expected value. While the values obtained from the initial temperature is about 22 °C, which can be reasonable since the set-up of the experiment was performed in a much colder environment. The place where the set-up of the experiment is being performed has a high impact in attaining accurate results.

Figure 1. The attendance of the group during the day of the experiment

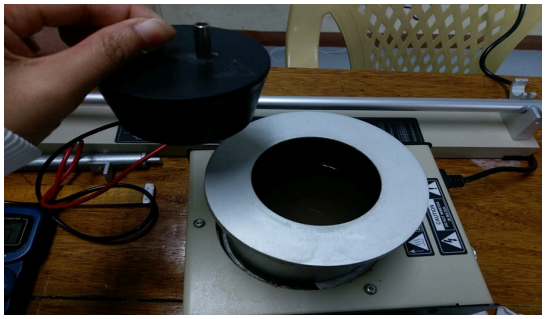

Figure 2. Checking the amount of water inside the steam generator

Figure 3. Ella was measuring the length of the rod.

Figure 4. They were replacing the tubes.

Conclusions

The students were able to determine the coefficient of linear expansion and the length of the Aluminum tube and the Steel tube after being exposed to heat. In this experiment, it was observed that as the tube is being exposed to a higher degree of temperature, there was an expansion observed wherein the aluminum tube's change in length is about 1.27 mm and for the steel tube is about 0.60 mm. Although both tubes have shown its increase in length after exposure to heat, they have different values as shown in Table 1. The aluminum has shown greater increase in length than that of the steel tube, and the aluminum's coefficient of linear expansion is also greater than that of the steel tube. It can be concluded that the amount of change in the length of a certain material may vary upon the coefficient of the linear expansion of the material being tested. The higher the coefficient of linear expansion may give a higher change in length.

From the experiment performed, the percent error in obtaining the coefficient of linear expansion of the aluminum tube is 37.82 %, and for the steel tube, the percent error is about 39.66%. These errors were obtained may due to the lack of experience and expertise of the students of the group who performed the experiment, and also, the environment wherein the experiment took place is also not the ideal place to perform this particular experiment, since the room used in performing the experiment is cold. The results that the students of the group gathered is reasonable since the temperature in the environment has a great impact in obtaining accurate results. To improve the results of the experiment, the temperature of the place or the environment where the experiment is going to take place should be taken into consideration, it is best to perform the experiment in a "room temperature".

In creating railroads, It is important to take into consideration their coefficient of thermal expansion. For example in railroads, since the tracks in railroads are made of steel, it is subjected to expand in a sunny day. The tracks of the railroads should have a gap for thermal expansion so that there is room for tracks to slide.